APPENDIX D
UNPAVED ROAD RUNOFF SEDIMENT ASSESSMENT

MIDDLE AND LOWER BIG HOLE RIVER WATER QUALITY RESTORATION PLANNING AREAS

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1.0 INTRODUCTION

This report presents an assessment of sediment loading from unpaved roads within most of the watersheds on the 2006 303(d) List for sediment-related impairment in the Middle and Lower Big Hole TMDL planning area. This assessment employed GIS, field data collection, and sediment modeling to assess sediment inputs from the unpaved road network to the stream network. Methods employed in this assessment are outlined in the *Middle and Lower Big Hole TMDL Planning Area Sediment Monitoring Quality Assurance Project Plan* (MDEQ 2005). Additional information regarding GIS techniques, and monitoring site selection can be found in the Sampling and Analysis Plan for this project: *Middle and Lower Big Hole TPA Unpaved Road Sediment Monitoring Plan* (MDEQ 2006). Sediment loading for unpaved roads in the French Creek watershed was not initially assessed as part of this effort but was performed later and the assessment results are included as an addendum in **Section 4.1** of this appendix.

2.0 DATA COLLECTION AND EXTRAPOLATION

Prior to field data collection, GIS layers of the stream network and road network were used to identify unpaved road crossings throughout the Middle and Lower Big Hole watershed. Areas where the road encroaches upon the stream channel, referred to as "near-stream" road segments, were also identified in GIS. Each identified unpaved road crossing and near-stream road segment was assigned attributes for road name, surface type, road ownership/management, stream name, subwatershed and landscape setting. A subset of unpaved road crossings representing the range of conditions identified in GIS was selected for field evaluation.

2.1 Field Data Collection

Unpaved road crossings and near-stream segments were assessed on each landscape type in proportion to their overall abundance, as described in the *Middle and Lower Big Hole TPA Unpaved Road Sediment Monitoring Plan* (MDEQ 2006), which outlined a strategy to sample approximately 5 percent of the unpaved road crossings on each landscape type. A total of 1,123 unpaved crossings were identified prior to field data collection. Eleven percent of the crossings (123) were within the valley landscape type, 24 percent (273 crossings) fell within the foothill landscape type, and 65 percent (727 crossings) fell within the mountain landscape type (MDEQ 2006).

A total of 53 unpaved road crossings and 34 near-stream segments were assessed in the field using the Forest Road Sedimentation Assessment Methodology (FroSAM) (**Figures 2-1** through **2-5**). Thirty-two crossings were assessed on the mountain landscape, while 13 crossings were assessed on the foothill landscape, and 7 crossings were assessed on the valley landscape. In the field, near stream segments were selected based on best professional judgment while traveling roads on which specific crossings were selected for evaluation. On the mountain landscape, 25 near-stream road segments were assessed, while 9 near-stream road segments on the foothill landscape were assessed. No near-stream segments were assessed on the valley landscape due to the small overall area of valley landscape and the observation that the majority of the roads were paved and/or did not parallel a stream channel.

Near-stream segments were initially defined as unpaved roads within 150 feet of the stream channel, though this was reduced to 100 feet after observing a lack of sediment contribution from roads farther away, which was primarily due to vegetative buffer, and valley topography. Sediment contribution from near-stream road segments will be described in this report based on "input-points" since it was observed in the field that sediment contribution tended to occur at certain points along a near-stream segment of road.

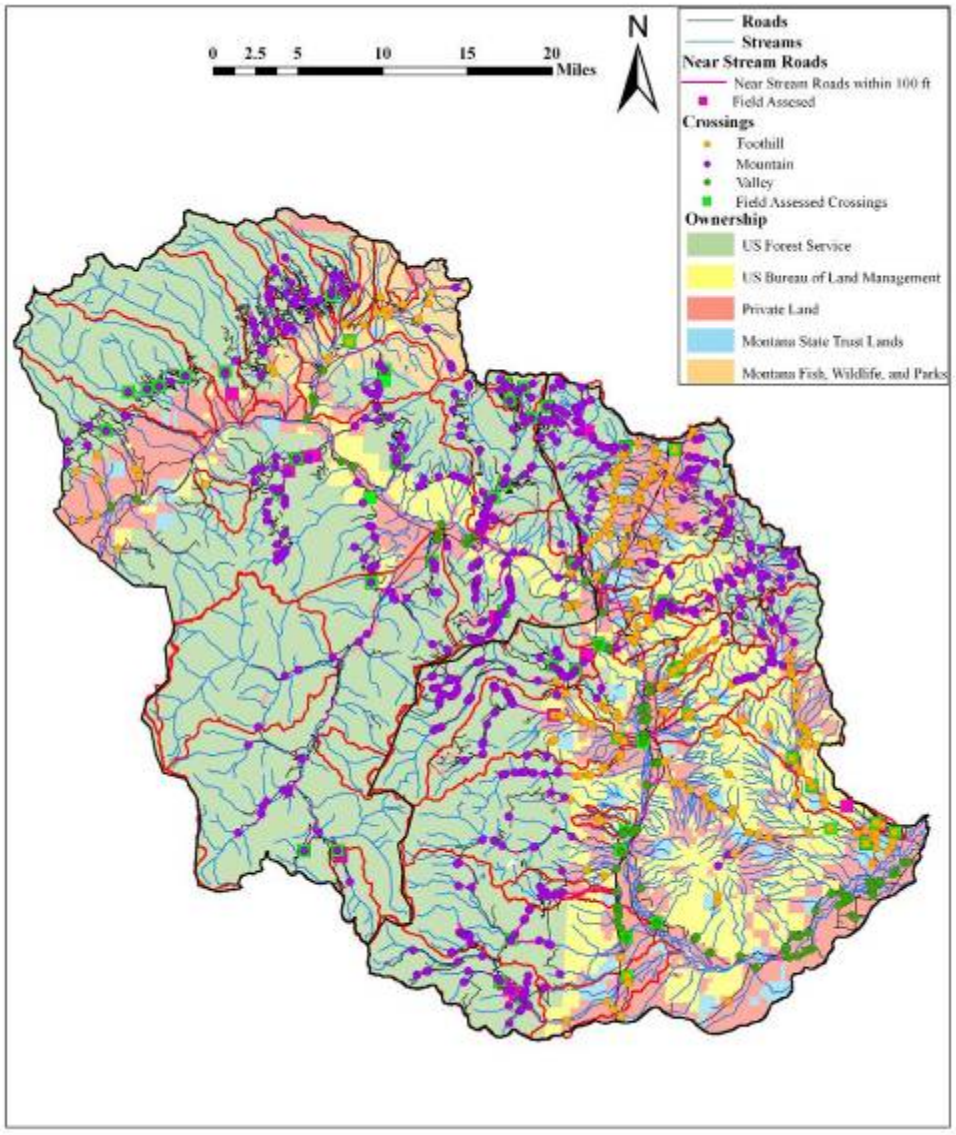

Figure 2-1. Overview of Middle and Lower Big Hole Road Network.

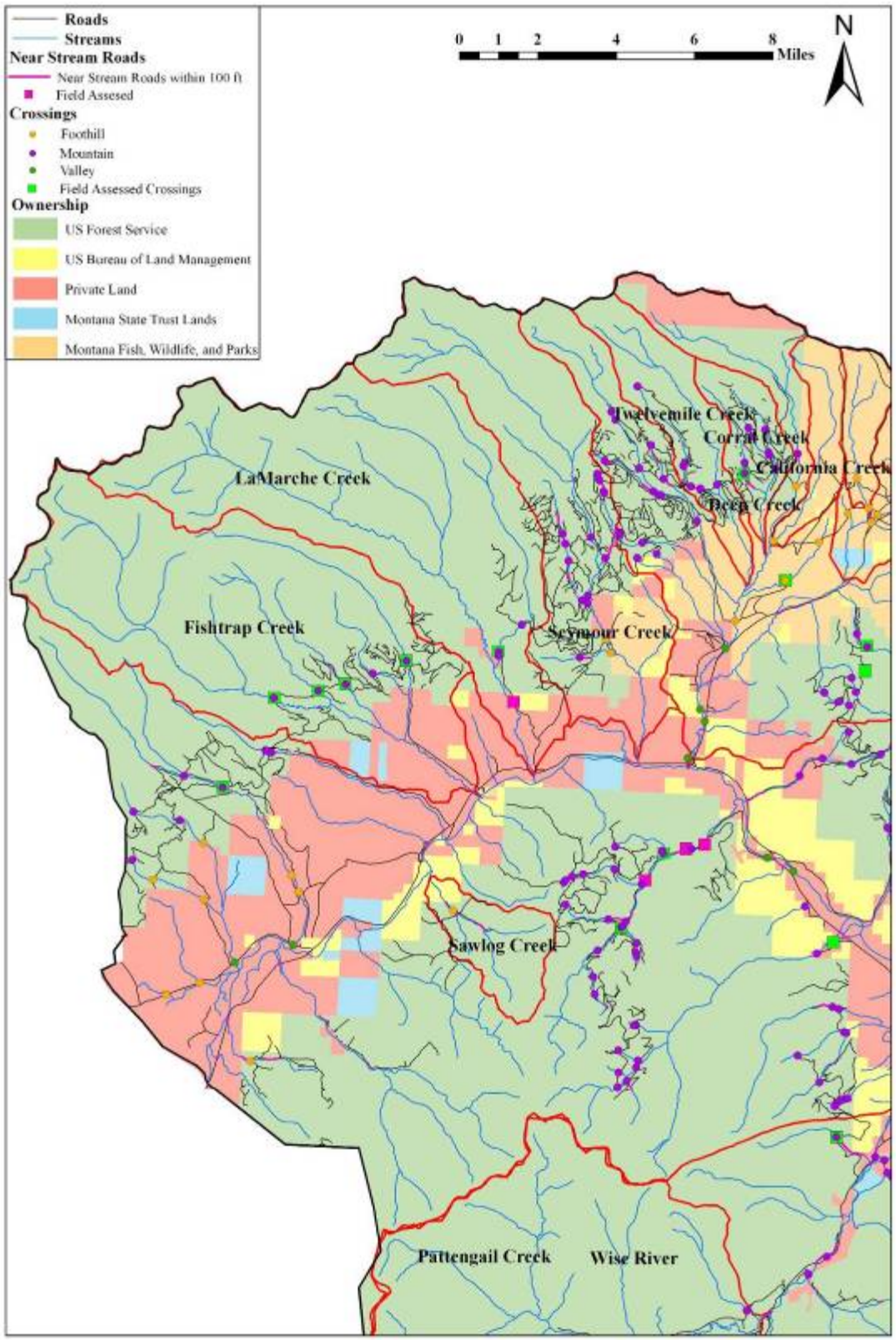

Figure 2-2. Middle and Lower Big Hole Road Network (northwest portion).

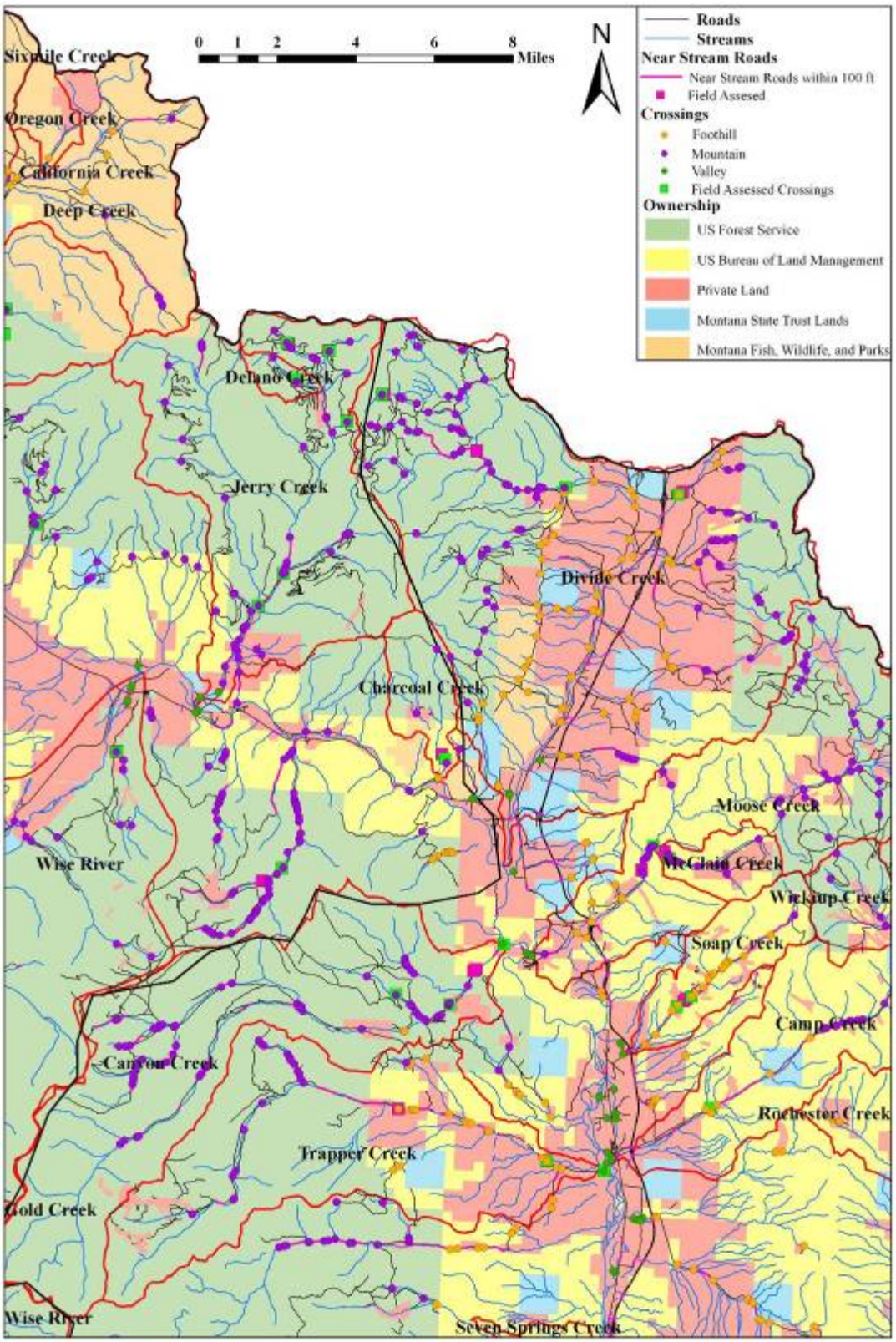

Figure 2-3. Middle and Lower Big Hole Road Network (northeast portion).

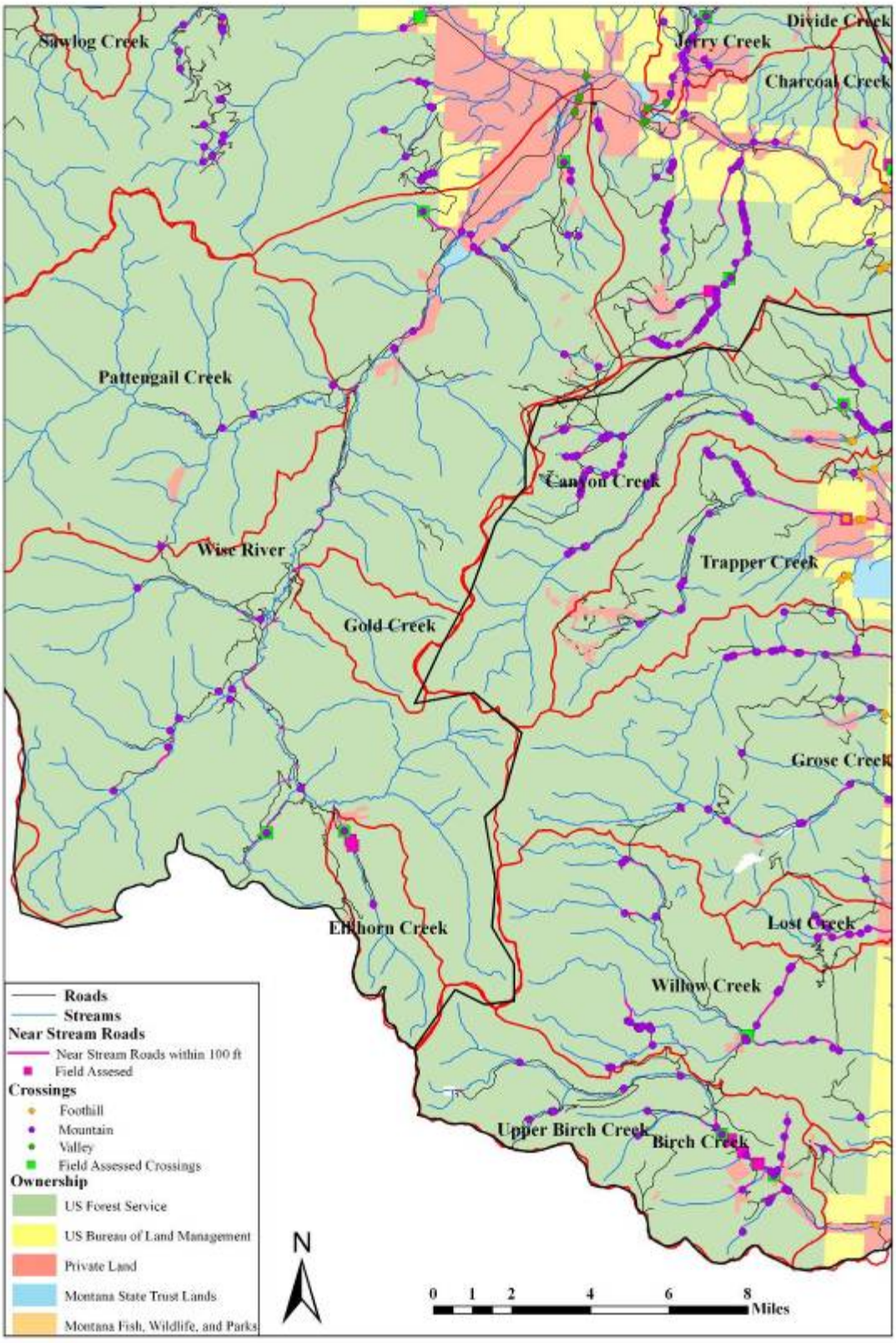

Figure 2-4. Middle and Lower Big Hole Road Network (southwest portion).

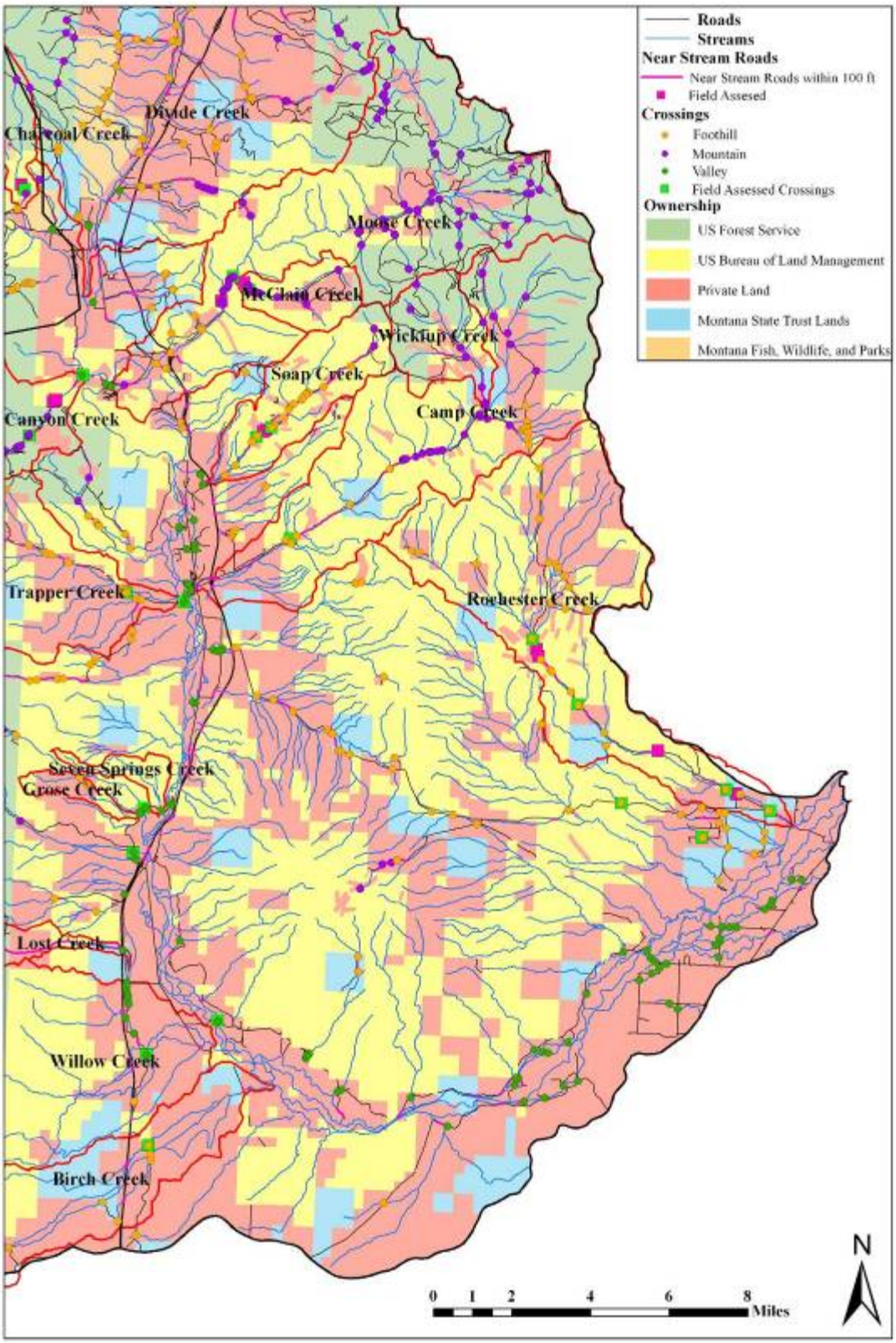

Figure 2-5. Middle and Lower Big Hole Road Network (southeast portion).

2.2 Mean Sediment Loads

Based on data collected in the field, the mean sediment contribution from both unpaved road crossings, and near-stream road segments was determined for each landscape type. Sediment loads from unpaved road crossings on the mountain landscape averaged an estimated 0.76 tons/year (**Table 2-1**). On the foothill landscape, sediment contributions from unpaved road crossings averaged an estimated 0.96 tons/year, while on the valley landscape sediment contributions from unpaved road crossings averaged an estimated 0.39 tons/year. Near-stream road segments contributed an average of an estimated 0.56 tons/year on the mountain landscape, and 0.58 tons/year on the foothill landscape. No near-stream road segments were assessed on the valley landscape, because of the small overall area of valley landscape, where the majority of the roads were paved and/or did not parallel the stream channels. The complete field dataset, along with the FroSAM modeled sediment loads, is presented in **Attachment A** and GPS points of the assessment sites are presented in **Attachment B**.

Table 2-1. Mean Sediment Loads from Field-assessed Road Crossings and Near-stream Road Segments.

Sediment Source	Landscape Type	Number of Sites Assessed	Mean Sediment Load (Tons/Year)
Crossing	Mountain	33	0.76
Crossing	Foothill	13	0.96
Crossing	Valley	7	0.39
	TOTAL	***53***	
Near-stream	Mountain	25	0.56
Near-stream	Foothill	9	0.58
Near-stream	Valley	0	no data
	TOTAL	***34***	

2.3 Extrapolation of Sediment Loads to the Watershed Scale

The sediment load (tons/year) from unpaved road crossing was calculated based on landscape type, the number of unpaved road crossings, and the length of unpaved road within 100 feet of a stream channel. The average sediment contribution from unpaved road crossings, and near-stream road segments was used to assign sediment loads to sites not assessed in the field. Sediment loads from unpaved road crossings were assigned based on landscape type. For near-stream road segments, an average of 0.57 tons/year was used on all landscape types.

2.3.1 Error Reduction

Following field data collection, GIS data was reviewed for accuracy. This review was conducted since field observations suggested that the GIS script used to generate stream crossings tended to over-estimate the number of crossings in situations where a stream was paralleled by a road in a relatively narrow or confined valley bottom. This over-estimation was due to inherent inaccuracies associated with the road, and stream layers used. The error percentage for the

unpaved road crossings within the 19 2004 listed watersheds was evaluated through a detailed visual assessment of 2005 color aerial imagery, along with site-specific knowledge, and ground-truthing during field assessment. One-hundred percent of the GIS identified road crossings were reviewed within the watersheds of the 19 segments listed as impaired due to sediment in 2004, and the suspected incorrect crossings were removed from the tally for each watershed that appeared on the 2004 303(d) List as impaired due to sediment (crossings were not manually removed from the GIS file). An average percentage of error per landscape type was determined based on this review. The valley crossings were highly accurate and had 0 percent error. The foothill crossings had an average error of 4 percent, and the mountain crossings had an error of 28 percent. Error rates in the GIS assessment were closely tied to stream valley confinement. These percentages were then extrapolated to the 1996 303(d) Listed watersheds, and the Middle and Lower Big Hole watershed. This lead to a reduction in the number of crossings originally assigned through GIS for the site selection process. The total number of unpaved road crossings originally delineated in GIS was reduced from 1,123 to 908 **(Table 2-2)**. While there is no way of knowing the exact number of crossings with complete certainty given the imprecise GIS data layers, the adjusted number is thought to be more accurate than the original number.

Table 2-2. Refined Number of Unpaved Road Crossings.

Landscape	Unpaved Road Crossings According to GIS Analysis	Unpaved Road Crossings with Aerial Photo and Field Assessment Adjustment
Mountain	727	523
Foothill	273	262
Valley	123	123
Total	**1,123**	**908**

Near-stream road segments were initially defined as unpaved roads within 150 feet of the stream channel using GIS, though this was reduced to 100 feet after noting a lack of sediment contribution from roads farther away. Similar to the road crossings, inaccuracies in the GIS roads, and stream layers make it difficult to evaluate the actual length of road within 100 feet of the channel. Initially, a total of 232.2 miles of road were identified in the Middle and Lower Big Hole watershed as being within 150 feet of a stream, with 206.3 miles of unpaved road. When unpaved roads within 100 feet of the stream were examined, there were 80.9 miles. However, using this number to calculate sediment loads would lead to an over-estimate of sediment contributions from near-stream segments since this distance includes road lengths already accounted for at crossings. An average of 270 feet of contributing road length was determined for each crossing. Thus, the near-stream road length was recalculated by subtracting the average length of the field assessed road crossings (270 feet) for each crossing from the overall road length. This eliminated load duplication for near-stream road segments and crossings.

Sediment loads were assigned to near-stream roads segments based on the length of road contributing at an “input point”, since unpaved roads were observed to contribute sediment to stream channels at identifiable points during field data collection. The average contributing length for near-stream road segments assessed in the field was 265 feet. This contributing length was estimated to represent the length of road contributing appreciable sediment to an identified “input point” for every 1,100 feet of unpaved road within 100 feet of the stream. This means that

each assessed near-stream segment "input point" accounted for 24 percent (i.e. 265/1,100) of the total near-stream road length measured in GIS. To adjust for this contribution per 1,100 feet of near-stream road, the total near stream road length for each subwatershed was divided by 265 feet to estimate the total number of near-stream road segments, and then 24 percent of that number was used to represent the total length of each segment that contributes sediment to the stream channel **(Table 2-3)**.

Table 2-3. Refined Near-stream Road Segment Lengths.

Landscape	Unpaved Road within 100 Feet (Miles)	Estimated Contributing Length of Parallel Roads within 100 Feet (Miles)	Estimated Number of Near -stream Road Segments with appreciable "Input Points"
Mountain	46.5	11.2	222
Foothill	23.3	5.6	112
Valley	11.1	2.7	53
Total	**80.9**	**19.4**	**387**

3.0 SEDIMENT LOAD ANALYSIS

The sediment loads were calculated by landscape type using the refined number of unpaved road crossings and near stream road segments **(Table 3-1).** The overall watershed scale sediment load from unpaved road crossings is estimated at 694.8 tons/year, while near-stream road segments contribute an estimated 220.6 tons of sediment per year.

Table 3-1. Estimated Sediment Loads from Unpaved Road Crossings and Near-stream Road Segments by Landscape Type.

Sediment Source	Landscape Type	Number of Sites	Mean Sediment Load (Tons/Year)	Total Sediment Load (Tons/Year)
Crossing	Mountain	523	0.76	398
Crossing	Foothill	262	0.96	249
Crossing	Valley	123	0.39	48
TOTAL		**908**		***695***
N-stream	Mountain	222	0.56	124
N-stream	Foothill	112	0.58	65
N-stream	Valley	53	0.57	30
TOTAL		**387**		***219***

3.1 Road Ownership

Unpaved road crossings and near-stream road segments were classified by watershed, landscape type, and land ownership. Several entities are responsible for land management in the Middle and Lower Big Hole TPA, including the State of Montana (both Montana Fish, Wildlife and Parks and Montana Trust managed lands), the U.S. Bureau of Land Management, U. S. Forest Service, and private landowners. Road ownership and maintenance responsibilities fall on the federal land management agencies, local counties, and private landowners. Data for the number of crossings, and near stream road segments are presented in **Table 3-2** and **Table 3-3** for each landowner. Estimated sediment loads resulting from the unpaved road network are presented for each landowner in **Tables 3-4**, **3-5** and **3-6**. Sediment loads were calculated using the average sediment load per landscape type from **Table 2-1**, and the number of crossings and near-stream segments presented in **Tables 3-4** and **3-5**.

Table 3-2. Number of Unpaved Road Crossings.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	# of Crossings			# of Crossings			# of Crossings			# of Crossings			# of Crossings			# of Crossings
	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Upper Birch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	**18**
California	0	5	2	0	0	0	0	1	0	0	0	0	0	0	0	**8**
Camp	0	0	0	0	1	1	0	7	10	0	4	8	0	0	4	**35**
Corral	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	**7**
Deep	0	9	6	0	0	0	3	1	0	0	0	1	0	1	31	**52**
Delano	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	**2**
Divide	0	7	0	0	5	0	3	39	22	0	0	0	0	3	55	**134**
Fishtrap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	**5**
Gold	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Grose	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	**2**
Lost	0	0	0	1	0	0	0	0	0	0	0	0	0	0	6	**7**
Oregon	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Pattengail	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	**4**
Rochester	0	0	0	0	4	0	0	17	0	0	6	0	0	0	0	**27**
Sawlog	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**1**
Sevenmile	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Sixmile	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Soap Gulch	0	0	0	0	0	0	1	3	0	0	18	2	0	0	0	**24**
Trapper	0	0	0	0	0	0	0	7	0	0	5	0	0	1	3	**16**
Lower Birch	0	0	0	0	1	0	0	5	0	0	0	0	0	0	1	**6**
Canyon	0	0	0	0	0	0	1	0	0	0	0	0	0	2	50	**53**
Charcoal Gulch	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	**2**
Elkhorn	0	0	0	0	0	0	18	0	0	0	0	0	0	0	1	**19**
Jerry	0	0	0	1	0	0	1	0	13	0	0	1	0	0	29	**45**
LaMarche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	**2**
McClain	0	0	0	0	0	0	0	0	1	0	0	8	0	0	0	**9**
Moose	0	0	0	0	0	0	1	6	12	1	0	20	0	0	17	**57**
Seven Springs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Seymour	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	**12**
Twelvemile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	**5**
Willow	0	0	0	0	0	0	12	1	1	0	0	0	0	0	22	**36**
Wise	0	0	0	0	0	0	4	0	3	0	0	0	0	0	22	**29**
Wickiup	0	0	0	0	0	1	0	0	3	0	0	1	0	0	1	**6**
Middle and Lower BigHole Combined	1	18	6	3	27	4	117	143	76	2	54	40	1	20	395	**909**
Middle Big Hole	1	12	6	1	0	3	17	8	22	2	0	9	1	13	191	**285**
Lower Big Hole	0	7	0	2	27	1	100	135	55	0	54	32	0	7	204	**624**

Table 3-3. Number and Length of Near-stream Segments.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total	Total
Watershed	# of near stream segments			# of near stream segments			# of near stream segments			# of near stream segments			# of near stream segments			# of near stream segments	Near stream length (ft)
	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn		
Upper Birch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	**17**	**4632**
California	0	4	1	0	0	0	0	1	0	0	0	0	0	0	0	**6**	**1496**
Camp	0	0	0	0	1	1	0	4	5	0	2	4	0	0	2	**19**	**4910**
Corral	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	**2**	**446**
Deep	0	3	2	0	0	0	1	0	0	0	0	0	0	0	11	**18**	**4757**
Delano	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**11**
Divide	0	3	0	0	2	0	1	14	8	0	0	0	0	1	20	**49**	**12925**
Fishtrap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**198**
Gold	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Grose	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	**1**	**299**
Lost	0	0	0	3	0	0	0	0	0	0	0	0	0	0	16	**18**	**4840**
Oregon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**18**
Pattengail	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**49**
Rochester	0	0	0	0	1	0	0	5	0	0	2	0	0	0	0	**8**	**2249**
Sawlog	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**2**	**420**
Sevenmile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**16**
Sixmile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**60**
Soap Gulch	0	0	0	0	0	0	1	2	0	0	10	1	0	0	0	**13**	**3494**
Trapper	0	0	0	0	0	0	0	9	0	0	6	0	0	1	4	**20**	**5355**
Lower Birch	0	0	0	0	1	0	0	4	0	0	0	0	0	0	1	**5**	**1303**
Canyon	0	0	0	0	0	0	0	0	0	0	0	0	0	1	22	**24**	**6266**
Charcoal Gulch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**270**
Elkhorn	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	**3**	**668**
Jerry	0	0	0	0	0	0	0	0	5	0	0	1	0	0	11	**18**	**4770**
LaMarche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**82**
McClain	0	0	0	0	0	0	0	0	1	0	0	5	0	0	0	**6**	**1468**
Moose	0	0	0	0	0	0	0	2	4	0	0	6	0	0	5	**18**	**4642**
Seven Springs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**67**
Seymour	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	**9**	**2485**
Twelvemile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	**3**	**712**
Willow	0	0	0	0	0	0	8	1	1	0	0	0	0	0	14	**24**	**6305**
Wise	0	0	0	0	0	0	3	0	2	0	0	0	0	0	15	**20**	**5248**
Wickiup	0	0	0	0	0	1	0	0	2	0	0	0	0	0	1	**4**	**1071**
Middle and Lower BigHole Combined	0	8	3	1	11	2	50	61	32	1	23	17	1	9	168	**387**	**102539**
Middle Big Hole	0	5	3	0	0	1	7	3	9	1	0	4	1	6	82	**122**	**32419**
Lower Big Hole	0	3	0	1	11	1	43	58	23	0	23	13	0	3	87	**265**	**70296**

Table 3-4. Sediment Loading from Unpaved Road Crossings.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load
	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	(tons/year)
Upper Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	**13.7**
California	0.0	4.8	1.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**7.2**
Camp	0.0	0.0	0.0	0.0	1.0	0.8	0.0	6.7	7.6	0.0	3.8	6.1	0.0	0.0	3.0	**28.9**
Corral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	**5.3**
Deep	0.0	8.6	4.6	0.0	0.0	0.0	1.2	1.0	0.0	0.0	0.0	0.8	0.0	1.0	23.6	**40.5**
Delano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	**1.5**
Divide	0.0	6.7	0.0	0.0	4.8	0.0	1.2	37.1	16.7	0.0	0.0	0.0	0.0	2.9	41.8	**111.0**
Fishtrap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	**3.8**
Gold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Grose	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**
Lost	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	**5.0**
Oregon	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.0**
Pattengail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	**3.0**
Rochester	0.0	0.0	0.0	0.0	3.8	0.0	0.0	16.2	0.0	0.0	5.7	0.0	0.0	0.0	0.0	**25.7**
Sawlog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	**1.0**
Sevenmile	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.0**
Sixmile	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.0**
Soap Gulch	0.0	0.0	0.0	0.0	0.0	0.0	0.4	2.9	0.0	0.0	17.1	1.5	0.0	0.0	0.0	**21.9**
Trapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	4.8	0.0	0.0	1.0	2.3	**14.6**
Lower Birch	0.0	0.0	0.0	0.0	0.9	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.5	**6.0**
Canyon	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.8	37.8	**40.0**
Charcoal Gulch	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	**1.6**
Elkhorn	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	**8.1**
Jerry	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0	9.8	0.0	0.0	1.1	0.0	0.0	21.9	**33.6**
LaMarche	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	**1.6**
McClain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	6.0	0.0	0.0	0.0	**7.1**
Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.4	5.5	9.3	0.4	0.0	15.3	0.0	0.0	13.1	**44.0**
Seven Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Seymour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	7.7	**9.5**
Twelvemile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	**3.8**
Willow	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.9	1.1	0.0	0.0	0.0	0.0	0.0	16.4	**23.1**
Wise	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	2.2	0.0	0.0	0.0	0.0	0.0	17.0	**20.7**
Wickiup	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	2.2	0.0	0.0	0.5	0.0	0.0	1.1	**4.9**
Middle and Lower Big Hole Combined	0.4	17.3	4.9	1.2	25.5	3.3	45.6	135.9	58.0	0.8	51.1	30.6	0.6	19.2	300.4	**694.8**
Middle Big Hole	0.4	10.9	4.9	0.4	0.0	2.2	6.6	7.3	16.4	0.8	0.0	6.6	0.6	12.8	145.0	**214.9**
Lower Big Hole	0.0	6.4	0.0	0.8	25.5	1.1	39.0	128.6	41.6	0.0	51.1	24.1	0.0	6.4	155.4	**479.9**

Table 3-5. Sediment Loading from Near-stream Segments.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)
	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	
Upper Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	**10.0**
California	0.0	2.0	0.8	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.2**
Camp	0.0	0.0	0.0	0.0	0.3	0.3	0.0	2.1	3.0	0.0	1.2	2.4	0.0	0.0	1.2	**10.6**
Corral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	**1.0**
Deep	0.0	1.8	1.2	0.0	0.0	0.0	0.6	0.2	0.0	0.0	0.0	0.2	0.0	0.2	6.1	**10.2**
Delano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Divide	0.0	1.5	0.0	0.0	1.0	0.0	0.6	8.1	4.6	0.0	0.0	0.0	0.0	0.6	11.4	**27.8**
Fishtrap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	**0.4**
Gold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Grose	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.6**
Lost	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	**10.4**
Oregon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Pattengail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**0.1**
Rochester	0.0	0.0	0.0	0.0	0.7	0.0	0.0	3.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	**4.8**
Sawlog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	**0.9**
Sevenmile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Sixmile	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
Soap Gulch	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.0	0.0	5.6	0.6	0.0	0.0	0.0	**7.5**
Trapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	3.6	0.0	0.0	0.7	2.2	**11.5**
Lower Birch	0.0	0.0	0.0	0.0	0.4	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	**2.8**
Canyon	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.5	12.7	**13.5**
Charcoal Gulch	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	**0.6**
Elkhorn	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**1.4**
Jerry	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	2.9	0.0	0.0	0.3	0.0	0.0	6.5	**10.3**
LaMarche	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	**0.2**
McClain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	2.7	0.0	0.0	0.0	**3.2**
Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	2.1	0.2	0.0	3.5	0.0	0.0	3.0	**10.0**
Seven Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Seymour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	4.5	**5.3**
Twelvemile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	**1.5**
Willow	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.4	0.5	0.0	0.0	0.0	0.0	0.0	8.1	**13.6**
Wise	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.1	0.0	0.0	0.0	0.0	0.0	8.6	**11.3**
Wickiup	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.0	0.0	0.0	0.3	0.0	0.0	0.5	**2.3**
Middle and Lower Big Hole Combined	0.2	4.4	1.6	0.7	6.5	1.0	28.4	34.7	18.5	0.5	13.0	9.8	0.3	4.9	95.9	**220.6**
Middle Big Hole	0.2	2.8	1.6	0.2	0.0	0.7	4.2	1.9	5.3	0.5	0.0	2.1	0.4	3.3	46.6	**69.7**
Lower Big Hole	0.0	1.6	0.0	0.5	6.5	0.3	24.2	32.8	13.3	0.0	13.0	7.7	0.0	1.6	49.6	**151.2**

Table 3-6. Total Sediment Loading from Unpaved Roads.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)
	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Upper Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.6	23.6
California	0.0	6.8	2.3	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4
Camp	0.0	0.0	0.0	0.0	1.3	1.1	0.0	8.8	10.6	0.0	5.0	8.5	0.0	0.0	4.2	39.4
Corral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	6.3
Deep	0.0	10.3	5.7	0.0	0.0	0.0	1.8	1.1	0.0	0.0	0.0	1.0	0.0	1.1	29.7	50.7
Delano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5
Divide	0.0	8.1	0.0	0.0	5.8	0.0	1.8	45.1	21.3	0.0	0.0	0.0	0.0	3.5	53.2	138.8
Fishtrap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	4.2
Gold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grose	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Lost	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	15.4
Oregon	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Pattengail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.1
Rochester	0.0	0.0	0.0	0.0	4.5	0.0	0.0	19.2	0.0	0.0	6.8	0.0	0.0	0.0	0.0	30.5
Sawlog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	1.9
Sevenmile	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Sixmile	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
Soap Gulch	0.0	0.0	0.0	0.0	0.0	0.0	0.7	3.8	0.0	0.0	22.7	2.1	0.0	0.0	0.0	29.4
Trapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	0.0	0.0	8.3	0.0	0.0	1.7	4.4	26.1
Lower Birch	0.0	0.0	0.0	0.0	1.3	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.9	8.8
Canyon	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	2.3	50.5	53.4
Charcoal Gulch	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.7	2.2
Elkhorn	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	9.6
Jerry	0.0	0.0	0.0	0.6	0.0	0.0	0.6	0.0	12.8	0.0	0.0	1.4	0.0	0.0	28.4	43.9
LaMarche	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8
McClain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	8.7	0.0	0.0	0.0	10.3
Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.6	6.5	11.4	0.6	0.0	18.8	0.0	0.0	16.1	54.0
Seven Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seymour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	12.1	14.8
Twelvemile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	5.4
Willow	0.0	0.0	0.0	0.0	0.0	0.0	9.2	1.3	1.6	0.0	0.0	0.0	0.0	0.0	24.6	36.7
Wise	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	3.3	0.0	0.0	0.0	0.0	0.0	25.6	32.0
Wickiup	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	3.2	0.0	0.0	0.8	0.0	0.0	1.6	7.2
Middle and Lower Big Hole Combined	0.6	21.8	6.5	1.9	32.1	4.3	74.0	170.6	76.5	1.3	64.1	40.4	0.9	24.0	396.3	915.3
Middle Big Hole	0.6	13.8	6.5	0.6	0.0	2.9	10.8	9.2	21.7	1.3	0.0	8.7	0.9	16.1	191.6	284.6
Lower Big Hole	0.0	8.0	0.0	1.3	32.1	1.4	63.2	161.4	54.9	0.0	64.1	31.8	0.0	8.0	205.0	631.1

4.0 APPLICATION OF BEST MANAGEMENT PRACTICES

The application of Best Management Practices (BMPs) at unpaved road crossings and near-stream road segments would reduce the sediment load from the unpaved road network. Sediment load reductions due to BMPs was evaluated by reducing the contributing road length to 100 feet from each side of a crossing (200 feet total) and to 100 feet for each near-stream road segment. These parameters were applied in the FroSAM model to the crossings and near-stream segments assessed in the field to evaluate the potential for sediment load reductions through the application of BMPs. Crossing lengths that exceeded 200 feet were reduced to 200 feet for the tread length, cutslope length and fillslope length. For unpaved road crossings with contributing lengths less than 200 feet, no adjustment was made. Similarly, near-stream road lengths that exceeded 100 feet were reduced to 100 feet for the tread length, cutslope length and fillslope lengths. No adjustment was made for near-stream road lengths less than 100 feet.

Sediment loads following the application of BMPs were calculated for unpaved road crossings and near-stream segments using the FroSAM model. On average, sediment loads from unpaved road crossings on the mountain landscape were reduced from 0.76 tons/year to 0.55 tons/year (**Table 4-1**). On the foothill landscape, sediment contributions from unpaved road crossings were reduced from 0.96 tons/year to 0.58 tons/year, while on the valley landscape the average sediment contributions from unpaved road crossings remained the same (0.39 tons/year). Through the application of BMPs, the average sediment load from near-stream road segments was reduced from 0.56 tons/year to 0.25 tons/year on the mountain landscape and from 0.58 tons/year to 0.31 tons/year on the foothill landscape. No near-stream road segments were assessed on the valley landscape.

Average sediment loads in each landscape type were extrapolated to the watershed scale based on the number of crossings and length of near-stream road segments. The reduced loads per watershed, landscape type and ownership are shown in **Table 4-2** (Unpaved Crossings) and **Table 4-3** (Near-stream Roads) for the watersheds with sediment-related impairments on the 2006 303(d) List, including the entire middle and lower Big Hole TMDL Planning Area. Potential sediment load reductions achieved via BMP implementation are summarized in **Table 4-4**. With the application of BMPs, the estimated annual sediment load from unpaved roads in the Middle and Lower Big Hole TMDL Planning areas was reduced from 695 tons to 488 tons for unpaved crossings and from 219 tons to 105 tons for near-stream road segments. The overall potential for sediment load reduction from unpaved roads is 35 percent in the Middle and Lower Big Hole TPA, from an existing load of 915 tons/year to a load of 593 tons/year through the application of BMPs (**Table 4-5**).

Table 4-1. Estimated Average Reduction in Sediment Loading through the Application of Best Management Practices.

Sediment Source	Landscape Type	Number of Sites	Mean Sediment Load (Tons/Year)	Total Sediment Load (Tons/Year)
Crossing	Mountain	523	0.55	288
Crossing	Foothill	262	0.58	152
Crossing	Valley	123	0.39	48
TOTAL		**908**		***488***
Near-stream	Mountain	222	0.25	55
Near-stream	Foothill	112	0.31	35
Near-stream	Valley	53	0.28	15
TOTAL		**387**		***105***

Table 4-2. Sediment Loading from Unpaved Road Crossings with the Application of BMPs.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load
	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	(tons/year)
Upper Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	**9.9**
California	0.0	2.9	1.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4.6**
Camp	0.0	0.0	0.0	0.0	0.6	0.6	0.0	4.1	5.5	0.0	2.3	4.4	0.0	0.0	2.2	**19.6**
Corral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	**3.9**
Deep	0.0	5.2	3.3	0.0	0.0	0.0	1.2	0.6	0.0	0.0	0.0	0.6	0.0	0.6	17.1	**28.5**
Delano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	**1.1**
Divide	0.0	4.1	0.0	0.0	2.9	0.0	1.2	22.6	12.1	0.0	0.0	0.0	0.0	1.7	30.3	**74.8**
Fishtrap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	**2.8**
Gold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Grose	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.0**
Lost	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	**3.7**
Oregon	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.6**
Pattengail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	**2.2**
Rochester	0.0	0.0	0.0	0.0	2.3	0.0	0.0	9.9	0.0	0.0	3.5	0.0	0.0	0.0	0.0	**15.7**
Sawlog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	**0.6**
Sevenmile	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.6**
Sixmile	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.6**
Soap Gulch	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.7	0.0	0.0	10.4	1.1	0.0	0.0	0.0	**13.7**
Trapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	2.9	0.0	0.0	0.6	1.7	**9.2**
Lower Birch	0.0	0.0	0.0	0.0	0.6	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.4	**3.7**
Canyon	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	27.3	**28.8**
Charcoal Gulch	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	**1.2**
Elkhorn	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	**7.8**
Jerry	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0	7.1	0.0	0.0	0.8	0.0	0.0	15.8	**24.5**
LaMarche	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	**1.2**
McClain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	4.4	0.0	0.0	0.0	**5.1**
Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.3	6.7	0.4	0.0	11.1	0.0	0.0	9.5	**31.4**
Seven Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Seymour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	5.5	**6.7**
Twelvemile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	**2.8**
Willow	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.6	0.8	0.0	0.0	0.0	0.0	0.0	11.9	**17.9**
Wise	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	1.6	0.0	0.0	0.0	0.0	0.0	12.3	**15.4**
Wickiup	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	1.6	0.0	0.0	0.4	0.0	0.0	0.8	**3.6**
Middle and Lower BigHole Combined	0.4	10.6	3.6	1.2	15.6	2.4	45.6	83.0	42.0	0.8	31.2	22.2	0.6	11.7	217.4	**488.0**
Middle Big Hole	0.4	6.7	3.6	0.4	0.0	1.6	6.6	4.5	11.9	0.8	0.0	4.8	0.6	7.8	104.9	**154.4**
Lower Big Hole	0.0	3.9	0.0	0.8	15.6	0.8	39.0	78.5	30.1	0.0	31.2	17.4	0.0	3.9	112.5	**333.6**

Table 4-3. Sediment Loading from Near-stream Segments with the Application of BMPs.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)
	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	Valley	Foothill	Mtn	
Upper Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	**4.4**
California	0.0	1.1	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.7**
Camp	0.0	0.0	0.0	0.0	0.2	0.1	0.0	1.1	1.3	0.0	0.7	1.1	0.0	0.0	0.5	**5.0**
Corral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	**0.4**
Deep	0.0	1.0	0.5	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.1	0.0	0.1	2.7	**4.7**
Delano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Divide	0.0	0.8	0.0	0.0	0.6	0.0	0.3	4.4	2.0	0.0	0.0	0.0	0.0	0.3	5.0	**13.4**
Fishtrap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	**0.2**
Gold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Grose	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**
Lost	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	**4.6**
Oregon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Pattengail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Rochester	0.0	0.0	0.0	0.0	0.4	0.0	0.0	1.7	0.0	0.0	0.6	0.0	0.0	0.0	0.0	**2.6**
Sawlog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	**0.5**
Sevenmile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Sixmile	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
Soap Gulch	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.0	0.0	3.1	0.3	0.0	0.0	0.0	**4.0**
Trapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	2.0	0.0	0.0	0.4	0.9	**6.0**
Lower Birch	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**1.5**
Canyon	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	5.6	**6.0**
Charcoal Gulch	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	**0.3**
Elkhorn	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.7**
Jerry	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	1.3	0.0	0.0	0.1	0.0	0.0	2.9	**4.5**
LaMarche	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**0.1**
McClain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.2	0.0	0.0	0.0	**1.4**
Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.9	0.1	0.0	1.5	0.0	0.0	1.3	**4.5**
Seven Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Seymour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.0	**2.4**
Twelvemile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	**0.7**
Willow	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	3.6	**6.2**
Wise	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.5	0.0	0.0	0.0	0.0	0.0	3.8	**5.0**
Wickiup	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.2	**1.0**
Middle and Lower Big Hole Combined	0.1	2.4	0.7	0.4	3.5	0.5	13.9	18.9	8.1	0.2	7.1	4.3	0.2	2.7	42.1	**105.0**
Middle Big Hole	0.1	1.5	0.7	0.1	0.0	0.3	2.0	1.0	2.3	0.2	0.0	0.9	0.2	1.8	20.4	**31.7**
Lower Big Hole	0.0	0.9	0.0	0.2	3.5	0.2	11.9	17.8	5.8	0.0	7.1	3.4	0.0	0.9	21.7	**73.5**

Table 4-4. Total Sediment Loading from Unpaved Roads with the Application of BMPs.

Ownership	MT FWP			MT Trusts			Private			BLM			USFS			Total
Watershed	Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)			Load (tons/year)
	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	Valley	Foothill	Mountain	
Upper Birch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3
California	0.0	4.0	1.5	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2
Camp	0.0	0.0	0.0	0.0	0.7	0.7	0.0	5.2	6.8	0.0	3.0	5.5	0.0	0.0	2.7	24.6
Corral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	4.3
Deep	0.0	6.2	3.8	0.0	0.0	0.0	1.5	0.7	0.0	0.0	0.0	0.6	0.0	0.7	19.7	33.2
Delano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1
Divide	0.0	4.8	0.0	0.0	3.5	0.0	1.5	27.0	14.1	0.0	0.0	0.0	0.0	2.1	35.3	88.2
Fishtrap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	2.9
Gold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grose	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Lost	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	8.3
Oregon	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Pattengail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2
Rochester	0.0	0.0	0.0	0.0	2.7	0.0	0.0	11.5	0.0	0.0	4.1	0.0	0.0	0.0	0.0	18.3
Sawlog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
Sevenmile	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Sixmile	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Soap Gulch	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.3	0.0	0.0	13.5	1.4	0.0	0.0	0.0	17.7
Trapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0	4.9	0.0	0.0	1.0	2.6	15.2
Lower Birch	0.0	0.0	0.0	0.0	0.8	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.5	5.2
Canyon	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.4	32.9	34.8
Charcoal Gulch	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	1.4
Elkhorn	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	8.5
Jerry	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	8.4	0.0	0.0	0.9	0.0	0.0	18.7	29.1
LaMarche	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3
McClain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	5.5	0.0	0.0	0.0	6.5
Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.5	3.9	7.7	0.5	0.0	12.6	0.0	0.0	10.8	35.9
Seven Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seymour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	7.5	9.1
Twelvemile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	3.4
Willow	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.8	1.0	0.0	0.0	0.0	0.0	0.0	15.4	24.1
Wise	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	2.1	0.0	0.0	0.0	0.0	0.0	16.1	20.5
Wickiup	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	0.5	0.0	0.0	1.0	4.6
Middle and Lower BigHole Combined	0.5	13.0	4.3	1.5	19.1	2.8	59.6	101.8	50.1	1.0	38.3	26.5	0.7	14.4	259.5	593.0
Middle Big Hole	0.5	8.2	4.3	0.5	0.0	1.9	8.7	5.5	14.2	1.0	0.0	5.7	0.7	9.6	125.4	186.1
Lower Big Hole	0.0	4.8	0.0	1.0	19.1	0.9	50.9	96.4	35.9	0.0	38.3	20.8	0.0	4.8	134.2	407.1

Table 4-5. Percent Reduction in Sediment Loading through the Application of BMPs.

Watershed	Total Sediment Load from Unpaved Roads (tons/year)	Total Sediment Load from Unpaved Roads with the Application of BMPs (tons/year)	Potential Reduction in Sediment Load through the Application of BMPs (tons/year)	Percent Reduction in Sediment Load through the Application of BMPs
Upper Birch	23.6	14.3	9.4	40%
California	10.4	6.2	4.2	40%
Camp	39.4	24.6	14.8	38%
Corral	6.3	4.3	2.0	32%
Deep	50.7	33.2	17.5	35%
Delano	1.5	1.1	0.4	28%
Divide	138.8	88.2	50.5	36%
Fishtrap	4.2	2.9	1.3	31%
French	17.7	11.0	6.7	38%
Gold	0.0	0.0	0.0	0%
Grose	2.0	1.3	0.7	34%
Lost	15.4	8.3	7.0	46%
Oregon	1.0	0.6	0.4	39%
Pattengail	3.1	2.2	0.9	29%
Rochester	30.5	18.3	12.2	40%
Sawlog	1.9	1.1	0.8	42%
Sevenmile	1.0	0.6	0.4	39%
Sixmile	1.1	0.7	0.4	40%
Soap Gulch	29.4	17.7	11.7	40%
Trapper	26.1	15.2	10.9	42%
Lower Birch	8.8	5.2	3.6	41%
Canyon	53.4	34.8	18.6	35%
Charcoal Gulch	2.2	1.4	0.8	35%
Elkhorn	9.6	8.5	1.0	11%
Jerry	43.9	29.1	14.8	34%
LaMarche	1.8	1.3	0.6	30%
McClain	10.3	6.5	3.7	36%
Moose	54.0	35.9	18.0	33%
Seven Springs	0.0	0.0	0.0	0%
Seymour	14.8	9.1	5.7	39%
Twelvemile	5.4	3.4	1.9	36%
Willow	36.7	24.1	12.5	34%
Wise	32.0	20.5	11.5	36%
Wickiup	7.2	4.6	2.7	37%
Middle and Lower Big Hole Combined	915.3	593.0	322.3	35%
Middle Big Hole	284.6	186.1	98.5	35%
Lower Big Hole	631.1	407.1	224.0	35%

4.1 French Creek Addendum

The French Creek watershed was not assessed individually during the forest road assessment since it was not listed as impaired due to sediment, but was assessed later after a review of existing data, and comparison to targets indicated French Creek may not be fully supporting all beneficial uses due to excess sediment. However, during the initial assessment, sediment loads from unpaved roads for three sub-watersheds were assessed: California Creek, Sixmile Creek, and Oregon Creek. The sediment load for the Deep Creek watershed, to which French Creek is a significant tributary, was also assessed. During TMDL compilation, an additional assessment of sediment loads from the unpaved road network within the French Creek watershed outside of the California, Sixmile and Oregon Creek watersheds was performed. During this assessment, total of 8 additional unpaved road crossings were identified using GIS. All crossings were located on the mountain landscape on lands managed by the Beaverhead-Deerlodge National Forest. Following error reduction procedures outlined in **Section 2.3.1**, this number was reduced by 28 percent, for an estimate of 6 additional road crossings. This results in a total of 16 road crossings in the French Creek watershed. In addition to road crossings, an additional 1,735 feet of road within 100 feet of a stream channel was identified in GIS, which brings the total to 3,309 feet in the French Creek watershed. Based on this assessment, it was estimated that unpaved roads in the French Creek watershed contribute an annual sediment load of 17.7 tons. With the application of BMPs, it is estimated that this load could be reduce by 38 percent to 11.0 tons/year.

5.0 REFERENCES

Montana DEQ 2005. Middle and Lower Big Hole TMDL Planning Area Sediment Monitoring Quality Assurance Project Plan (QAPP). Prepared by PBS&J, Helena, Montana. Prepared for Montana Department of Environmental Quality, Water Quality Planning Bureau, Helena, Montana.

Montana DEQ 2006. Middle and Lower Big Hole TPA Unpaved Road Sediment Monitoring Plan. Prepared by PBS&J, Helena, Montana. Prepared for Montana Department of Environmental Quality, Water Quality Planning Bureau, Helena, Montana.

ATTACHMENT A
FIELD DATA AND FROSAM MODELED SEDIMENT LOADS

MIDDLE AND LOWER BIG HOLE RIVER TMDL PLANNING AREAS

	TREAD											CUTSLOPE									FILLSLOPE									TOTAL	
Location Number	Tread Length (ft)	Tread Width (ft)	Acres of Tread	Base Erosion Rate (tons/ac/yr)	Gravel Factor	Traffic Factor	Percent Cover	Cover Factor	Percent Delivery	Delivery Factor	Tread Delivery (tons/yr)	Cutslope Length (ft)	Avg. Cutslope Width (ft)	Acres of Cutslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Percent Delivery	Delivery Factor	Cutslope Delivery (tons/yr)	Fillslope Length (ft)	Avg. Fillslope Width (ft)	Acres of Fillslope	Base Erosion Rate (tons/ac/yr)	Percent Cover	Cover Factor	Percent Delivery	Delivery Factor	Fillslope Delivery (tons/yr)	*Location Total Sediment (tons/yr)*	Landscape
ATV	25	8	0.005	30	1	1	70	0.23	75	0.75	0.02376			0.000	30				0	0.00000			0.000	30				0	0.00000	0.024	Mountain
N-100	320	20	0.147	30	1	1	0	1	5	0.05	0.22033	280	8	0.051	30	50	0.37	5	0.05	0.02854	320	15	0.110	30	30	0.15	5	0.05	0.02479	0.274	Mountain
N-1001	320	17	0.125	30	1	1	0	1	5	0.05	0.18733			0.000	30				0	0.00000			0.000	30				0	0.00000	0.187	Mountain
N-1034	350	12	0.096	30	1	1	60	0.3	5	0.05	0.04339	70	8	0.013	30	70	0.23	5	0.05	0.00444			0.000	30				0	0.00000	0.048	Mountain
N-1056	375	18	0.155	30	1	1	0	1	50	0.5	2.32438	375	15	0.129	30	50	0.37	50	0.5	0.71668	375	12	0.103	30	50	0.37	50	0.5	0.57335	3.614	Mountain
N-1243	195	13	0.058	30	1	1	10	0.77	25	0.25	0.33608	195	2	0.009	30	30	0.53	25	0.25	0.03559			0.000	30				0	0.00000	0.372	Mountain
N-1254	220	13	0.066	30	0.5	1	20	0.63	50	0.5	0.31023	70	10	0.016	30	80	0.18	5	0.05	0.00434	220	5	0.025	30	90	0.15	75	0.75	0.08523	0.400	Mountain
N-134	580	12	0.160	30	1	1	20	0.63	25	0.25	0.75436			0.000	30				0	0.00000			0.000	30				0	0.00000	0.755	Foothill
N-1370	245	16	0.090	30	1	1	0	1	25	0.25	0.67493			0.000	30				0	0.00000	15	3	0.001	30	70	0.23	75	0.75	0.00535	0.680	Foothill
N-235	120	15	0.041	30	1	1	10	0.77	50	0.5	0.47727	120	12	0.033	30	70	0.23	75	0.75	0.17107	60	6	0.008	30	80	0.18	100	1	0.04463	0.693	Foothill
N-236	260	15	0.090	30	1	1	0	1	5	0.05	0.13430	110	8	0.020	30	60	0.3	5	0.05	0.00303			0.000	30				0	0.00000	0.143	Foothill
N-251	120	24	0.066	30	1	1	0	1	5	0.05	0.09317			0.000	30				0	0.00000			0.000	30				0	0.00000	0.093	Foothill
N-278	165	20	0.076	30	1	1	0	1	50	0.5	1.13636	165	3	0.034	30	20	0.63	50	0.5	0.32216	165	7	0.027	30	30	0.53	50	0.5	0.21080	1.669	Foothill
N-381	250	22	0.126	30	1	1	0	1	5	0.05	0.18939			0.000	30				0	0.00000			0.000	30				0	0.00000	0.189	Foothill
N-526	420	10	0.096	30	1	1	50	0.37	50	0.5	0.53512			0.000	30				0	0.00000			0.000	30				0	0.00000	0.535	Mountain
N-654	70	15	0.024	30	0.5	2	0	1	75	0.75	0.54236	65	15	0.022	30	60	0.3	25	0.25	0.05036	20	5	0.002	30	80	0.18	75	0.75	0.00330	0.602	Mountain
N-655	180	12	0.050	30	1	1	30	0.53	50	0.5	0.39421	180	12	0.050	30	70	0.23	50	0.5	0.17107			0.000	30				0	0.00000	0.565	Mountain
N-659	375	13	0.112	30	1	1	20	0.63	5	0.05	0.10576	375	15	0.129	30	90	0.15	25	0.25	0.14527	100	15	0.034	30	80	0.18	5	0.05	0.00930	0.260	Mountain
N-703	245	17	0.096	30	1	1	50	0.37	75	0.75	0.79600			0.000	30				0	0.00000			0.000	30				0	0.00000	0.796	Mountain
N-738	130	20	0.087	30	1	1	0	1	5	0.05	0.13085			0.000	30				0	0.00000	130	8	0.035	30	70	0.23	100	1	0.24077	0.372	Mountain
N-781	270	15	0.093	30	1	1	10	0.77	5	0.05	0.10739			0.000	30				0	0.00000	270	10	0.062	30	90	0.15	5	0.05	0.01395	0.121	Mountain
N-826	290	16	0.107	30	1	1	20	0.63	25	0.25	0.50331	220	5	0.025	30	90	0.15	25	0.25	0.02841			0.000	30				0	0.00000	0.532	Mountain
N-866	180	20	0.083	30	1	1	20	0.63	5	0.05	0.07810	180	15	0.062	30	80	0.18	5	0.05	0.01674	180	8	0.033	30	90	0.15	5	0.05	0.00744	0.102	Mountain
N-928	490	22	0.247	30	1	1	0	1	5	0.05	0.37121	490	7	0.079	30	70	0.23	5	0.05	0.02717	490	15	0.169	30	90	0.15	5	0.05	0.03796	0.436	Mountain
N-954	160	16	0.059	30	1	1	10	0.77	25	0.25	0.33933	160	5	0.018	30	40	0.45	25	0.25	0.06138	160	10	0.037	30	70	0.23	5	0.05	0.01267	0.414	Mountain
N-963	60	17	0.023	30	0.5	1	0	1	25	0.25	0.08781	85	8	0.016	30	70	0.23	25	0.25	0.02693			0.000	30				0	0.00000	0.115	Mountain
N-992	440	16	0.162	30	1	1	10	0.77	5	0.05	0.18667	85	10	0.020	30	50	0.37	5	0.05	0.01083			0.000	30				0	0.00000	0.137	Mountain
N-Bryant	220	20	0.101	30	1	1	20	0.63	5	0.05	0.09545			0.000	30				0	0.00000	220	10	0.051	30	80	0.18	5	0.05	0.01364	0.109	Mountain
N-Bryant-2	575	24	0.317	30	1	2	20	0.63	5	0.05	0.59876	400	20	0.184	30	60	0.3	5	0.05	0.08264	45	10	0.010	30	90	0.15	5	0.05	0.00232	0.684	Mountain
N-Camp	165	15	0.057	30	1	1	20	0.63	75	0.75	0.80540			0.000	30				0	0.00000	10	6	0.001	30	50	0.37	75	0.75	0.01147	0.817	Foothill
N-Divide	250	13	0.075	30	1	1	20	0.63	5	0.05	0.07051	200	6	0.028	30	80	0.18	5	0.05	0.00744	250	3	0.017	30	90	0.15	5	0.05	0.00387	0.082	Mountain
N-Divide-2	210	20	0.096	30	0.5	1	0	1	75	0.75	1.08471	100	15	0.034	30	60	0.3	75	0.75	0.23244	60	10	0.014	30	90	0.15	5	0.05	0.00310	1.320	Mountain
N-Elkhorn	50	15	0.017	30	0.5	2	0	1	75	0.75	0.38740			0.000	30				0	0.00000	50	10	0.011	30	60	0.3	75	0.75	0.07748	0.465	Mountain
N-Soap	470	18	0.194	30	1	1	10	0.77	5	0.05	0.22432			0.000	30				0	0.00000			0.000	30				0	0.00000	0.224	Foothill
N-Trapper	170	15	0.059	30	1	1	10	0.77	75	0.75	1.01420	170	15	0.059	30	70	0.23	75	0.75	0.30294	170	5	0.020	30	80	0.18	100	1	0.10537	1.423	Mountain
X-100	380	15	0.131	30	1	1	0	1	25	0.25	0.38140			0.000	30				0	0.00000			0.000	30				0	0.00000	0.381	Mountain
X-1001	60	15	0.021	30	1	1	0	1	25	0.25	0.15436			0.000	30				0	0.00000	50	3	0.003	30	40	0.45	75	0.75	0.03487	0.190	Mountain
X-1006	22	15	0.008	30	1	1	70	0.23	5	0.05	0.00261			0.000	30				0	0.00000			0.000	30				0	0.00000	0.003	Mountain
X-1034	225	15	0.077	30	1	1	10	0.77	50	0.5	0.89483			0.000	30				0	0.00000	60	4	0.006	30	70	0.23	50	0.5	0.01301	0.914	Mountain
X-104	135	21	0.065	30	1	1	10	0.77	25	0.25	0.37585			0.000	30				0	0.00000			0.000	30				0	0.00000	0.376	Valley
X-1056	450	15	0.155	30	1	1	10	0.77	25	0.25	0.89489			0.000	30				0	0.00000			0.000	30				0	0.00000	0.895	Mountain
X-117	50	26	0.030	30	1	1	20	0.63	5	0.05	0.02820			0.000	30				0	0.00000	20	10	0.005	30	60	0.3	25	0.25	0.01033	0.039	Foothill
X-124	520	15	0.179	30	1	1	10	0.77	25	0.25	1.03409	430	18	0.178	30	50	0.37	25	0.25	0.49308	45	3	0.003	30	80	0.18	50	0.5	0.00837	1.536	Mountain
X-1243	165	14	0.053	30	1	1	0	1	75	0.75	1.19318	130	5	0.022	30	20	0.63	75	0.75	0.30314	15	2	0.001	30	40	0.45	100	1	0.00930	1.512	Mountain
X-1254	110	14	0.035	30	0.5	1	0	1	25	0.25	0.13258			0.000	30				0	0.00000	40	10	0.009	30	90	0.15	50	0.5	0.02066	0.153	Mountain
X-126	150	24	0.083	30	0.5	2	0	1	25	0.25	0.61983			0.000	30				0	0.00000	85	10	0.020	30	70	0.23	50	0.5	0.06732	0.687	Valley
X-130	20	12	0.006	30	1	1	0	1	50	0.5	0.08264			0.000	30				0	0.00000	20	5	0.002	30	50	0.37	100	1	0.02548	0.108	Valley
X-134	190	12	0.052	30	1	1	20	0.63	75	0.75	0.74194			0.000	30				0	0.00000			0.000	30				0	0.00000	0.742	Foothill
X-1370	100	15	0.034	30	1	1	20	0.63	25	0.25	0.16271	40	7	0.006	30	60	0.3	25	0.25	0.01446	100	3	0.007	30	80	0.18	50	0.5	0.01860	0.196	Foothill
X-235	400	15	0.138	30	1	1	20	0.63	5	0.05	0.13017			0.000	30				0	0.00000	40	2	0.002	30	80	0.18	75	0.75	0.00744	0.138	Foothill
X-236	680	14	0.219	30	1	1	0	1	25	0.25	1.63312			0.000	30				0	0.00000	30	4	0.003	30	30	0.15	75	0.75	0.00930	1.648	Foothill
X-251	180	22	0.091	30	1	1	0	1	25	0.25	0.68182			0.000	30				0	0.00000	20	3	0.001	30	80	0.18	75	0.75	0.00558	0.687	Foothill
X-278	24	22	0.012	30	1	2	0	1	75	0.75	0.54545			0.000	30				0	0.00000	24	4	0.002	30	30	0.53	100	1	0.03504	0.580	Foothill
X-283	290	14	0.093	30	1	1	30	0.53	25	0.25	0.37049			0.000	30				0	0.00000			0.000	30				0	0.00000	0.370	Foothill
X-30	150	18	0.062	30	1	1	0	1	25	0.25	0.46488			0.000	30				0	0.00000			0.000	30				0	0.00000	0.465	Valley
X-335	100	20	0.046	30	0.5	2	0	1	50	0.5	0.68871			0.000	30				0	0.00000	100	20	0.046	30	80	0.18	50	0.5	0.12397	0.813	Valley
X-34	25	22	0.013	30	1	1	10	0.77	5	0.05	0.01458			0.000	30				0	0.00000	10	3	0.001	30	60	0.3	100	1	0.00620	0.021	Valley
X-374	540	28	0.347	30	0.5	1	10	0.77	5	0.05	0.20045	260	16	0.096	30	70	0.23	5	0.05	0.03295	500	20	0.230	30	90	0.15	5	0.05	0.05165	0.285	Mountain
X-381	230	24	0.127	30	1	1	0	1	25	0.25	0.35041			0.000	30				0	0.00000	20	4	0.002	30	50	0.37	75	0.75	0.01523	0.366	Foothill
X-443	20	17	0.008	30	1	1	0	1	50	0.5	0.11708			0.000	30				0	0.00000	20	2	0.001	30	70		50	0.5	0.00000	0.117	Mountain
X-526	850	10	0.195	30	1	1	50	0.37	75	0.75	1.62448	260	14	0.084	30	20	0.63	75	0.75	1.18450	10	4	0.001	30	90		5	0.05	0.00000	2.803	Mountain
X-654	240	18	0.099	30	0.5	2	0	1	5	0.05	0.14876			0.000	30				0	0.00000	280	12	0.077	30	60	0.3	25	0.25	0.17355	0.322	Mountain
X-655	470	12	0.129	30	1	1	30	0.53	50	0.5	1.02934	50	12	0.014	30	40	0.45	50	0.5	0.03238	40	5	0.005	30	90	0.15	75	0.75	0.01550	1.138	Mountain
X-659	80	16	0.029	30	0.5	1	10	0.77	25	0.25	0.08485			0.000	30				0	0.00000	80	6	0.011	30	80	0.18	25	0.25	0.01488	0.100	Mountain
X-703	65	18	0.027	30	1	1	50	0.37	25	0.25	0.07454			0.000	30				0	0.00000	40	10	0.009	30	70	0.23	50	0.5	0.03168	0.106	Mountain
X-731	1000	18	0.413	30	1	1	10	0.77	25	0.25	2.38636			0.000	30				0	0.00000	25	5	0.003	30	80	0.18	75	0.75	0.01162	2.398	Mountain
X-738	65	20	0.030	30	1	2	0	1	50	0.5	0.89532			0.000	30				0	0.00000	40	4	0.004	30	80	0.18	75	0.75	0.01488	0.910	Mountain
X-781	475	12	0.131	30	1	1	50	0.37	100	1	1.45248	38	5	0.011	30	90	0.15	25	0.25	0.01265	20	10	0.005	30	90	0.15	25	0.25	0.00517	1.470	Mountain
X-836	140	21	0.067	30	1	1	10	0.77	75	0.75	1.16332			0.000	30				0	0.00000	55	13	0.016	30	15	0.7	75	0.75	0.25852	1.428	Mountain
X-837	260	18	0.107	30	1	1	20	0.63	25	0.25	0.50764	30	10	0.021	30	20	0.63	50	0.5	0.19525	65	12	0.018	30	80	0.18	50	0.5	0.04835	0.751	Mountain
X-839	75	18	0.031	30	1	1	20	0.63	5	0.05	0.02929	30	5	0.003	30	50	0.37	25	0.25	0.00356	75	10	0.017	30	50	0.37	25	0.25	0.04778	0.087	Mountain
X-840	270	18	0.112	30	1	1	0	1	25	0.25	0.83678	270	10	0.062	30	50	0.37	5	0.05	0.03440	60	5	0.007	30	50	0.37	50	0.5	0.03822	0.909	Mountain
X-845	35	15	0.033	30	1	1	10	0.77	25	0.25	0.16892			0.000	30				0	0.00000	180	12	0.050	30	80	0.18	5	0.05	0.01339	0.202	Mountain
X-866	405	15	0.139	30	1	1	10	0.77	5	0.05	0.16108	220	20	0.101	30	40	0.45	25	0.25	0.34031	120	12	0.033	30	90	0.15	5	0.05	0.00744	0.509	Mountain
X-31	25	20	0.011	30	1	1	0	1	75	0.75	0.25826			0.000	30				0	0.00000	20	1	0.000	30	50	0.37	75	0.75	0.00382	0.262	Valley
X-328	320	15	0.110	30	1	1	0	1	25	0.25	0.82645	230	8	0.042	30	80	0.18	25	0.25	0.05702	10	5	0.001	30	90	0.15	75	0.75	0.00387	0.887	Mountain
X-346	120	20	0.055	30	1	1	10	0.77	25	0.25	0.31818			0.000	30				0	0.00000	120	15	0.041	30	60		50	0.5	0.00000	0.318	Mountain
X-352	85	17	0.033	30	1	1	10	0.77	50	0.5	0.38314			0.000	30				0	0.00000	40	15	0.014	30	90	0.15	5	0.05	0.00310	0.386	Mountain
X-354	220	16	0.081	30	1	1	10	0.77	25	0.25	0.46667	50	15	0.017	30	20	0.63	100	1	0.32541	135	18	0.056	30	90	0.15	25	0.25	0.06276	0.855	Mountain
X-362	420	15	0.145	30	0.5	1	0	1	5	0.05	0.10847	360	20	0.165	30	50	0.37	25	0.25	0.45868	100	30	0.069	30	90	0.15	5	0.05	0.01550	0.583	Mountain
X-363	160	17	0.062	30	0.5	1	0	1	25	0.25	0.23416	120	20	0.055	30	60	0.3	5	0.05	0.02479	60	6	0.008	30	90	0.15	50	0.5	0.01860	0.278	Mountain
X-392	340	15	0.117	30	1	1	40	0.45	25	0.25	0.39514	150	20	0.069	30	50	0.37	25	0.25	0.19112	50	5	0.006	30	80	0.18	50	0.5	0.01550	0.602	Mountain
X-Camp	390	15	0.134	30	1	1	20	0.63	100	1	2.53822			0.000	30				0	0.00000			0.000	30				0	0.00000	2.538	Foothill
X-Canyon	190	15	0.065	30	1	1	10	0.77	100	1	1.51136	110	8	0.020	30	30	0.53	100	1	0.32121			0.000	30				0	0.00000	1.833	Mountain
X-Divide	300	13	0.090	30	1	1	20	0.63	25	0.25	0.42304	170	10	0.039	30	50	0.37	5	0.05	0.02166	60	5	0.007	30	30	0.15	5	0.05	0.00155	0.446	Mountain
X-Melrose	1500	5	0.172	30	1	2	10	0.77	25	0.25	1.38864			0.000	30				0	0.00000			0.000	30				0	0.00000	1.389	Foothill
X-Soap	300	15	0.103	30	1	1	0	1	50	0.5	1.54359	110	8	0.020	30	40	0.45	50	0.5	0.13636	70	10	0.016	30	70	0.23	75	0.75	0.08316	1.763	Foothill
X-Trap-2	195	22	0.098	30	1	1	0	1	25	0.25	0.73864			0.000	30				0	0.00000	22	5	0.003	30	60	0.3	100	1	0.02273	0.761	Foothill

Location Number	Comments
ATV	ATV stream crossing in wet meadow
N-100	periodic culverts drain road, ~40' to channel
N-1001	road mostly away from stream
N-1034	between drain dips, ~30' to channel
N-1056	measured between 2 waterbars, sediment deposition evident in gulch, road parrallels channel in drainage, is within 15 feet in many places, dry gulch
N-1243	designed drain dip transport sediment 50'+ from road, ~70' to channel
N-1254	~5' to channel in places, direct delivery where berm fails
N-134	road puddles in depressional area before crossing, flows out toward channel, ~25' to channel
N-1370	fillslope leading to stream, ~10' to channel, inputs where road slopes toward channel
N-235	contribution from multiple rills on fillslope, ~5' to channel, which is more of a "wetland"
N-236	puddle spills over onto vegetative buffer, road drains both ways, ~80' to channel
N-251	flat, bladed road with berms and a sandy surface, ~60 to channel
N-278	obvious input point at rill, ~70' to channel
N-381	wetland buffer in flat valley bottom, ~70' to channel
N-526	long contributing road segment with defined rills, bermed road, ~30' to channel
N-654	short contributing section within ~5' of channel, small contributing fillslope
N-655	rolling dip discharges toward channel, ~40 to channel down steep bank
N-659	culvert drains ditch that intercepts springs, though much of road outsloped from ditch
N-703	input upstream of crossing, ~15' to channel
N-738	channel encroachment for ~130', with high delivery from fillslope, though road sloped toward hillslope
N-781	vegetative buffer on fillslope, cutslope erosion retained in ditch, ~80' to channel
N-826	road drains both directions, ~12' to channel, beaver dams in stream raise water elevation
N-866	shale field cutslope, vegetation on fillslope, ~60' to channel
N-928	~110' to channel with 100' sediment plume below culvert, plume captured by flat vegetated valley bottom
N-954	cutslope leads to culvert that has a minor BMP at outlet, ~50' to channel
N-963	sediment basin, springs, ~20' to channel
N-992	road drains both directions, ~30' to channel
N-Bryant	road primarily outsloped, vegetated buffer, cutslope interceptd by ditch, ~40' to channel
N-Bryant-2	vegetative buffer on fillslope, ~100' to channel
N-Camp	road outsloped toward stream, direct fillslope contribution
N-Divide	much of sediment appears to settle on road prior to crossing, ~50' to channel
N-Divide-2	road insloped toward ditch, relief culvert with sediment plume, ~20' to channel
N-Elkhorn	short contributing section within ~5' of channel, much of road outsloped or flat
N-Soap	rill down road outlets at break in berm, vegetative buffer intercepts plume, ~60' to channel
N-Trapper	road encroachment, ditch drains into culverts then to channel, fillslope mostly rocky
X-100	limited input due to flat road and vegetative buffer
X-1001	bridge raised, fill slopes deliver sediment, stream ford downstream of bridge is also a source
X-1006	input limited since road runoff delivered downslope of crossing
X-1034	road downslopes toward crossing, livestock trail provides input point
X-104	gravel carried onto bridge by traffic then transported to channel, fillslope barrier
X-1056	rills on road lead to crossing, small ditches on both sides, most delivery at upstream side, some vegetative buffer, dry gulch
X-117	bridge structure appears to prevent most sediment delivery
X-124	large cutslope leads around bend to crossing, some vegetative buffer
X-1243	measured from drainage dip, large rills and direct delivery at crossing, cutslopes on both sides of road
X-1254	berms reduce input, rocky/vegetated fillslopes
X-126	parking area drainging into culvert may provide additional contribution
X-130	sediment input from fillslope and road only at crossing
X-134	substantial road drainage, flow appears to go into ditch approximately 25 feet from crossing which has some vegetative filter
X-1370	limited input, dry gulch
X-235	some road erosion appears to be captured in a puddle that acts as a sediment trap
X-236	road contributing from both directions, rills in road and puddle at crossing berms at crossing may limit delivery
X-251	road draining from both sides, though is somewhat outsloped
X-278	bladed road with berms on both sides, blading contributes sediment at crossing
X-283	majority of road sediment discharged ~20 upslope of crossing, dry gulch
X-30	ditch transports some road sediment, fillslopes have barriers
X-335	gravel carried onto bridge by traffic then transported to channel
X-34	minimal delivery due to flat road and berm
X-374	large vegetated fillslope, stream through long culver
X-381	bladed road
X-443	minimal input from road due to outslope
X-526	long contributing road segment with defined rills and cutslope capture
X-654	measured from culvet, plume along vegetated ditch toward channel, delivery from fill
X-655	partial drain dip removes some of sediment, puddle near crossing appears to flow to channel
X-659	perched culvert, limited fillslope delivery
X-703	portion of eroding road surface captured by sediment basin
X-731	long contributing road length, somewhat naturally graveled, low delivery due to flattening of slope at crossing
X-738	fillslope contribution, as well as portion of road up Farlin gulch
X-781	obvious sediment plume on bridge with depths of 0.1-0.2 feet directly contributing from steep rutted road, sand bars observed in stream below crossing
X-836	road sloping to downstream side of bridge with obvious delivery paths, cutslope appeared to wash off of outsloped road
X-837	road contribution appeared limited, though ditch at the base of the cut/fill slope appeared to be a pathway
X-839	basically flat road grade, minimal input from rocky cut and fillslopes
X-840	sediment delivery pathway at base of cutslope, ditched side of road appeared to have low delivery
X-845	measured from waterbar, fillslopes well vegetated, delivery appeared low
X-866	fillslope vegetated, large cutslope partially buffered by vegetation
X-91	gravel carried onto bridge by traffic then transported to channel, fillslope barrier
X-928	measured from waterbar, ditch with high transport capacity, wooden barrier on fillslope, some BMPs
X-946	fillslope contribution
X-952	measured from drainage dip, fillslope and ditches well vegetated
X-954	minimal input from road, cutslope has direct delivery
X-962	large, rocky fillslope, some cutslope delivery
X-963	road outsloped toward culvert outlet
X-992	contributing road measured from observed discharge point down to crossing, dry gulch
X-Camp	road draining from both sides to stream ford, large gullies leading to channel
X-Canyon	2nd ford progressing downstream, with significant contributing road length
X-Divide	road outsloped, cutslope erosion mostly intercepted by vegetation
X-Melrose	long, contributing road segments from both sides, plus ditch, plume of sediment observed in the dry gulch
X-Soap	input above and below actual crossing
X-Trap-2	sediment plume within 5' of channel, direct fillslope contribution

ATTACHMENT B
GPS POINTS

MIDDLE AND LOWER BIG HOLE RIVER TMDL PLANNING AREAS

Site	Latitude	Longitude	Landscape	Remarks
X-117	45.42145	-112.69723	Foothill	
X-1370	45.68413	-112.65562	Foothill	
X-235	45.59029	-112.48137	Foothill	
X-278	45.55370	-112.37826	Foothill	
X-236	45.61366	-112.50634	Foothill	
X-283	45.54299	-112.41351	Foothill	
X-374	45.87400	-112.72560	Mountain	
X-134	45.95381	-113.06976	Foothill	
X-251	45.56096	-112.40148	Foothill	
X-Melrose	45.55454	-112.45637	Foothill	
X-Camp	45.64726	-112.63583	Foothill	
X-Soap	45.68806	-112.64799	Foothill	
X-Trap 2	45.62509	-112.72068	Foothill	
X-381	45.87302	-112.66528	Foothill	
X-1254	45.74316	-112.67142	Mountain	
X-1243	45.73854	-112.66254	Mountain	
X-781	45.82267	-113.14854	Mountain	
X-866	45.85083	-113.12771	Mountain	
X-526	45.77198	-112.78305	Mountain	
X-952	45.93089	-113.02503	Mountain	
X-954	45.92159	-113.02554	Mountain	
X-130	45.82078	-113.03591	Valley	
X-1006	45.74891	-113.02953	Mountain	
X-124	45.76954	-112.95626	Mountain	
X-992	45.68441	-112.80371	Mountain	
X-100	45.44974	-112.84022	Mountain	
X-703	45.51677	-113.09646	Mountain	
X-654	45.51869	-113.05617	Mountain	
X-738	45.39862	-112.82307	Mountain	
X-928	45.41299	-112.85146	Mountain	
X-1056	45.72925	-112.86663	Mountain	
X-1034	45.85191	-113.00432	Mountain	
X-443	45.82559	-112.88502	Mountain	
X-655	45.92307	-112.87583	Mountain	
X-659	45.90985	-112.86977	Mountain	
X-962	45.89509	-112.84217	Mountain	
X-946	45.83789	-112.87249	Mountain	
X-845	45.86746	-113.36263	Mountain	
X-836	45.91744	-113.26879	Mountain	
X-839	45.90479	-113.31467	Mountain	
X-840	45.90144	-113.33764	Mountain	
X-1001	45.92251	-113.22017	Mountain	
X-731	45.99235	-113.09446	Mountain	
X-837	45.90782	-113.30040	Mountain	
X-Canyon	45.68137	-112.77515	Mountain	
X-Divide	45.90545	-112.82440	Mountain	
X-963	45.92077	-112.85329	Mountain	
X-30	45.52925	-112.71150	Valley	
X-91	45.62226	-112.69035	Valley	
X-335	45.46853	-112.66366	Valley	
X-126	45.70448	-112.74823	Valley	

Site	Latitude	Longitude	Landscape	Remarks
X-34	45.54587	-112.70685	Valley	
X-104	45.45495	-112.70034	Valley	
N-1056	45.72415	-112.87672	Mountain	
N-1001	45.90418	-113.21088	Mountain	
N-134	45.95369	-113.07000	Foothill	
N-954	45.92172	-113.02550	Mountain	
N-781	45.84046	-113.13684	Mountain	
N-866	45.85290	-113.11608	Mountain	
N-Bryant	45.85474	-113.10627	Mountain	
N-Bryant 2	0.00000	0.00000	Mountain	No Satallites
N-1034	45.85324	-113.00493	Mountain	
N-Elkhorn	45.51351	-113.05122	Mountain	
N-654	45.51549	-113.05262	Mountain	
N-703	45.51670	-113.09660	Mountain	
N-526	45.77370	-112.78485	Mountain	
N-992	45.69421	-112.76342	Mountain	
N-826	45.69492	-112.76183	Mountain	
N-278	45.57438	-112.43829	Mountain	
N-236	45.61008	-112.50402	Foothill	
N-235	45.60748	-112.50289	Foothill	
N-251	45.55952	-112.39640	Foothill	
N-928	45.41100	-112.84666	Mountain	
N-100	45.40654	-112.83975	Mountain	
N-738	45.40254	-112.83154	Mountain	
N-Camp	45.64723	-112.63582	Foothill	
N-Soap	45.68700	-112.65074	Foothill	
N-1370	45.68629	-112.65208	Foothill	
N-Trapper	45.64209	-112.79984	Mountain	
N-1243	45.74112	-112.66547	Mountain	
N-1254	45.73391	-112.67698	Mountain	
N-Divide	45.90528	-112.82332	Mountain	
N-659	45.90910	-112.87001	Mountain	
N-655	45.92254	-112.87488	Mountain	
N-963	45.92081	-112.85361	Mountain	
N-Divide 2	45.88611	-112.77308	Mountain	
N-381	45.87411	-112.66346	Foothill	
ATV	45.76947	-112.95639	Mountain	